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1.1 Overview

The National Institute for Occupational Safety and Health (NIOSH) ¹ is the federal agency responsible for conducting research and making recommendations for the prevention of occupational illness and injury. NIOSH is part of the Centers for Disease Control and Prevention (CDC) in the Department of Health and Human Services (DHHS).

Surveillance data published by the U.S. Bureau of Labor Statistics (BLS) documents the burden of illness and injury associated with work. In 2002, there were 5,524 occupational fatalities in the private sector, an average of 15 per day. [1] In 2003, there were 4.4 million illnesses and non-fatal injuries in the private sector. [2] This human toll is accompanied by significant economic cost. The Liberty Mutual 2004 Workplace Safety Index estimated that direct costs for occupational injuries alone were \$49.6 billion in 2002. [3]

Changes in the workplace will likely create new challenges for preventing occupational illness and injury. As the U.S. economy shifts from manufacturing to services and industries shift from older to newer technologies, resulting changes in the distribution of jobs and their associated hazards will continue to occur.

Workforce demographics are also changing. By 2008, the U.S. workforce will grow to an estimated 155 million, with minorities constituting 28% of the workforce and women 48%. The workforce is also aging. By 2010, middle and older age workers will outnumber younger workers. Finally, important changes have occurred in the conditions under which work is performed: longer work hours, longer shifts, and compressed work weeks; part-time and temporary work; around-the-clock shift work; and reduced job security are all realities of the modern workplace. NIOSH must work not only to prevent the occupational illnesses and injuries of today, but also to anticipate and prevent those of tomorrow.

To meet these challenges, NIOSH is guided by its mission to provide national and world leadership to prevent work-related illnesses and injuries. [4] In carrying out this mission, NIOSH adheres to a core set of values:

- **Relevance** – Our programs are responsive to the occupational safety and health problems that are found in today's workplaces and the workplaces of tomorrow.
- **Diversity** – Our employees reflect the full spectrum of diversity found in the U.S. workforce and our research and interventions reflect the diversity of solutions needed for the U.S. workplace.
- **Quality** – We use only the best science, the highest level of data quality, and the most transparent and independent peer review.

¹ Appendix A includes a list of acronyms used throughout this report.

- Partnership – We accomplish our mission in partnership with employers and workers as well as in academia, industry, government, and scientific and professional communities, both nationally and internationally. These partnerships are formed strategically to identify occupational safety and health problems, improve planning, execution, and review of NIOSH research. They also help translate and transfer research outputs to the workplace.
- Access – Our customers can obtain all NIOSH products and services through expanded traditional and electronic access.
- Performance – Our programs are results-oriented.
- Accountability – Our programs are evaluated by how well they solve the occupational safety and health problems found in today's workplaces and the workplaces of tomorrow.

1.2 Legislative Foundations

The main legislative underpinnings of NIOSH are the Federal Coal Mine Health and Safety Act of 1969 (amended in 1977) [5] and the Occupational Safety and Health Act of 1970. [6] The “Coal Act” was passed in the aftermath of a devastating coal mine explosion that occurred in Farmington, West Virginia, in 1968. It took the lives of 78 miners and galvanized public opinion that stronger measures were needed to protect coal miners. Activities required by the Coal Act were split between the Department of Health, Education and Welfare, which engaged in non-regulatory activities such as health screening and research; and the Mine Enforcement and Safety Administration in the Department of the Interior (DOI), which engaged in developing and enforcing workplace safety and health regulations in the mining industry. NIOSH subsequently assumed the health screening and research responsibilities specified under the Coal Act after its creation by the Occupational Safety and Health Act of 1970 (see below). When the Coal Act was amended in 1977, the Mine Enforcement and Safety Administration was replaced by the Mine Safety and Health Administration (MSHA) in the Department of Labor.

The Occupational Safety and Health Act of 1970 (Public Law 91-596) [6], OSH Act of 1970 followed closely after the Coal Act. It created NIOSH and the Occupational Safety and Health Administration (OSHA). OSHA is in the U.S. Department of Labor and is responsible for developing and enforcing workplace safety and health regulations. NIOSH, in DHHS, was established to help assure safe and healthful working conditions for working men and women by providing research, information, education, and training in the field of occupational safety and health.

Information pertaining to the responsibilities of NIOSH is found in Section 22 of the Occupational Safety and Health Act of 1970 [29 Code of Federal Regulations (CFR) § 671]. The Institute is authorized to:

- Develop recommendations for occupational safety and health standards.
- Perform all functions of the Secretary of Health, Education and Welfare (subsequently Health and Human Services) under Sections 20 and 21 of the Act.
- Conduct research on worker safety and health (Section 20).
- Conduct training and employee education (Section 21).

- Develop information on safe levels of exposure to toxic materials and harmful physical agents and substance.
- Conduct research on new safety and health problems.
- Conduct on-site investigations to determine the toxicity of materials used in workplaces (Health Hazard Evaluations [HHEs] - 42 CFR Part 85; [7] and General Research Authority – 42 CFR Part 85a). [8]
- Fund research by other agencies or private organizations through grants, contracts, and other arrangements.

Thus, Congress has set a clear division between the research function of NIOSH and the regulatory and enforcement functions of MSHA and OSHA. Although NIOSH works together with MSHA and OSHA to achieve the common goal of protecting the safety and health of the national workforce, it simultaneously maintains its unique identity as the sole federal government organization primarily charged to conduct occupational safety and health research.

Through its legislated authorities, NIOSH provides national and world leadership to prevent work-related illness, injury, disability, and death by gathering information, conducting scientific research, and translating the knowledge gained into products and services.

1.3 Organizational Structure and Management

NIOSH is located within CDC, which is an organizational unit of DHHS. The NIOSH Director is appointed by the DHHS Secretary and reports to the CDC Director. DHHS has recently implemented performance-based management, in which management responsibilities cascade through the administrative structure. Thus, all managers have formal responsibilities written into their performance plans specifically tailored to support the responsibilities of others higher in the management chain. Under this system of management, responsibilities ultimately derive from priorities established by the Office of Management and Budget (OMB), a component of the White House.

The administrative structural components of NIOSH are shown in Figure 1.1. The main organizational units are divisions, laboratories, and offices. These are a mixture of disease and injury-specific divisions (respiratory diseases, safety research), expertise-specific divisions (applied research and technology, laboratory research, surveillance and field studies, education and information dissemination), and industry-specific units (mining). The divisions and laboratories are geographically dispersed in Cincinnati, Ohio; Morgantown, West Virginia; Pittsburgh, Pennsylvania; and Spokane, Washington. NIOSH leadership is located in Washington, DC and Atlanta, Georgia. To coordinate across these geographically dispersed units, NIOSH makes extensive use of modern information technology, including e-mail and video conferencing.

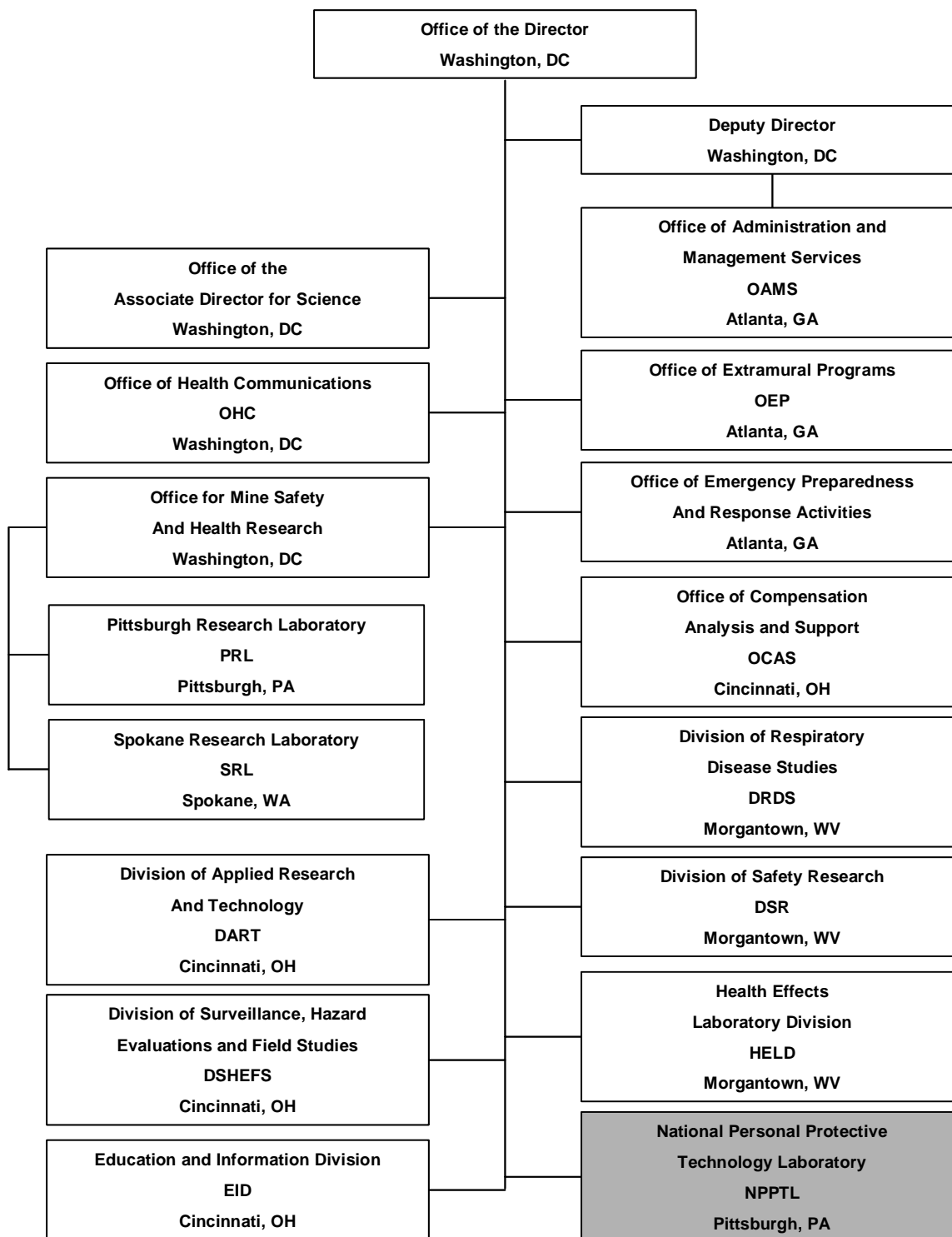


Figure 1.1 - Organizational Components of NIOSH

The National Occupational Research Agenda (NORA), a partnership program designed to stimulate innovative research and improved workplace practices, has been a research framework for NIOSH and the nation since 1996. Diverse parties collaborate to identify the most critical

issues in workplace safety and health. Partners work together to develop goals and objectives for addressing these needs.

The NIOSH Program Portfolio (Table 1.1) has been organized into:

- eight NORA Sector Programs that represent industrial sectors,
- 15 Cross-Sector Programs organized around adverse health outcomes, statutory programs, and global efforts, and
- eight Coordinated Emphasis Areas.

The Personal Protective Technology (PPT) Program is a Cross-Sector program.

Table 1.1 - NIOSH Program Portfolio

NORA Sector Programs (n=8)	
Agriculture, Forestry and Fishing	
Construction	
Healthcare and Social Assistance	
Manufacturing	
Mining	
Services	
Transportation, Warehousing and Utilities	
Wholesale and Retail Trade	
NIOSH Cross-Sector Programs (n=15)	
Personal Protective Technology	
Authoritative Recommendations	
Cancer, Repro and Cardiovascular	
Communications and Information Dissemination	
Emergency Preparedness/Response	
Global Collaborations	
Health Hazard Evaluation	
Hearing Loss Prevention	
Immune and Dermal	
Musculoskeletal Disorders	
Radiation Dose Reconstruction	
Respiratory Diseases	
Training Grants	
Traumatic Injury	
Work Organization and Stress-Related Disorders	
NIOSH Coordinated Emphasis Areas (n=8)	
Economics	
Engineering Controls	
Exposure Assessment	
Nanotechnology	
Occupational Health Disparities	
Small Business Assistance and Outreach	
Surveillance	
Work Life Initiative	

NIOSH manages the three broad components of its Program Portfolio across its organizational structure as depicted in Figure 1.2. Each cross-sector program (such as the PPT Program) has a manager who is a senior member of the NIOSH staff. Each is responsible for the activities conducted within the assigned program across the entire NIOSH divisional and laboratory structure.

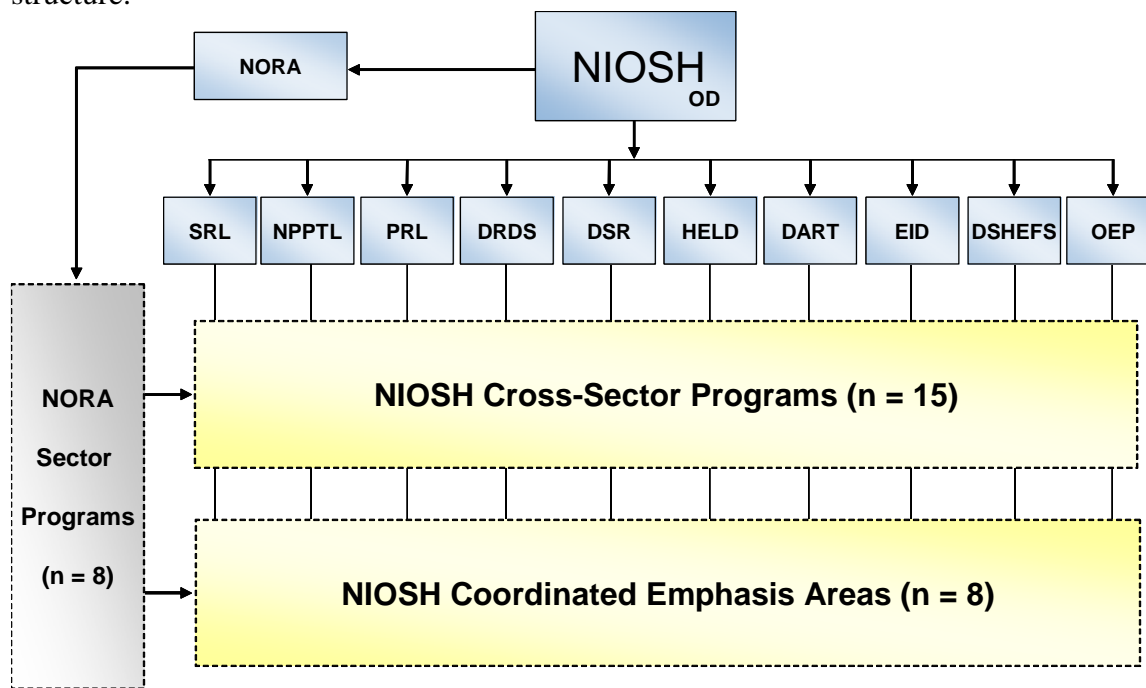


Figure 1.2 - NIOSH Program Portfolio

NIOSH has made an organizational commitment to performance-based management. It has recently developed several key performance indicators to track organizational performance. Examples include tracking financial performance by establishing and monitoring the percentage of total funding to divisions and laboratories used for discretionary purposes (i.e., not personnel, salary, and benefits). The NIOSH target is 25% discretionary by 2010. The fiscal year (FY) 2006 ratio was 20%. Another key performance indicator is optimizing the ratio of supervisory staff to non-supervisory staff. CDC established a FY 2006 goal of 1:10. In FY 2006, the NIOSH ratio was 1:13.

NIOSH management occurs within the context of broader federal management requirements and initiatives. The 1993 Government Performance and Results Act mandated that federal agencies develop multiyear strategic plans, annual performance plans, and annual performance reports.

Another management requirement is responsiveness to the OMB's Program Assessment Rating Tool [<http://www.whitehouse.gov/omb/part/>] which is used by the Office to assess federal agency performance on a number of measures including strategic planning, program management, and program results. The Program Assessment Rating Tool (PART) performance ratings are an important consideration in budget requests by the President. Current NIOSH key performance measures for PART were established in 2004. They target the following safety and health-focused achievements by 2014:

- 50% reduction in the respirable coal dust overexposures of operators of longwall and continuous mining machines, roofbolters, and surface drills.
- 40% reduction in the number of workers being struck by construction vehicles and equipment in the road construction industry.
- 75% of professional firefighters and first responders having access to Chemical, Biological, Radiological, and Nuclear (CBRN) respirators.

The last targeted achievement is an outcome derived directly from the activities of the PPT Program.

NIOSH receives external guidance and advice from two Advisory Committees. The Board of Scientific Counselors is composed of external authorities from a variety of fields related to occupational safety and health. Members of the Board of Scientific Counselors provide advice and guidance to NIOSH in developing and evaluating research hypotheses, systematically documenting findings, and disseminating results that will improve the safety and health of workers. They also evaluate the degree to which NIOSH activities:

- conform to standards of scientific excellence in accomplishing objectives in occupational safety and health;
- address relevant needs in occupational safety and health, either alone or in collaboration with activities outside of NIOSH; and
- produce their intended results in addressing important research questions in occupational safety and health, both in terms of applicability of the research findings and dissemination of the findings.

The Mine Safety and Health Research Advisory Committee (MSHRAC) performs a similar function, except it specifically focuses on issues related to occupational safety and health in mining.

Another source of external input to NIOSH is the National Advisory Committee on Occupational Safety and Health (NACOSH). NACOSH was created under Section Seven of the Occupational Safety and Health Act of 1970 to advise NIOSH and OSHA on occupational safety and health programs and policies. Members of the 12-person advisory committee are chosen on the basis of their knowledge and experience in occupational safety and health. Two members represent management, labor, the occupational health professions, and the occupational safety professions, and four members represent the public. Two of the health representatives and two of the public members are designated by the DHHS Secretary, although actual appointment of these members, as well as all other members, is by the Secretary of Labor. The members serve 2-year terms.

NIOSH and OSHA provide staff support for NACOSH. The Director of NIOSH and the Assistant Secretary of Labor for Occupational Safety and Health both usually attend NACOSH meetings. NACOSH is a vehicle not only for external input for the agencies but also a body to whom the agencies must be responsive. NACOSH meetings are held twice each year and are open to the public.

1.4 Resources

The NIOSH budget is a direct appropriation from Congress, as a specific line item in the DHHS/CDC appropriation. The Congressional language that accompanies the funding appropriation often contains specific directives about the intended use of portions of the funds. For example, these “earmarked” directives instruct NIOSH to use specific portions of the funds to conduct research which targets certain industries such as agriculture or construction, or to support research or surveillance initiatives such as NORA and Emergency Preparedness.

In addition, Congress or DHHS may charge NIOSH to lead or participate in evolving public health activities such as the World Trade Center health surveillance efforts; however, funding is not always provided to support these efforts. Prior to FY 2006, the CDC took a portion of the NIOSH budget to offset the cost of administrative and infrastructure support provided by the CDC and to fund the NIOSH portion of costs associated with business consolidations established under the President’s Management Agenda. Beginning in 2006, Congress moved the charges associated with business support services from the NIOSH appropriation and appropriated the funding directly to the CDC (approximately \$35 million). Escalating personnel costs, combined with projections of diminished appropriations and continuing earmark obligations, create significant challenges to NIOSH as it strives to fulfill its mission and optimize its impact on occupational safety and health problems.

In FY 2006, \$255 million was appropriated for NIOSH. Table 1.2 shows NIOSH funding for the years 2001 through 2006, with adjustments for inflation and application of the biomedical research index. The reduction between 2005 and 2006 reflects costs to NIOSH of CDC business consolidations. After adjustment of funding for the biomedical research and development price index (which adjusts not only for inflation but also for increased costs of conducting scientific investigations due to new technologies, among other factors), NIOSH has had only a modest increase in funding since 2001. Essentially all of the increase is the result of funding earmarked for NORA priorities.

Table 1.2 - NIOSH Budget, 2001 - 2006

	2001	2002	2003	2004	2005	2006
Budget (in millions)	\$260	\$276	\$273	\$277	\$286	\$255*
Adjusted (BRDPI)**	\$260	\$267	\$255	\$250	\$248	\$212

* In 2006, Congress redirected \$35M from the NIOSH budget appropriation to CDC for Business Support Services.

** NIH-Biomedical Research and Development Price Index (BRDPI). Figures shown as millions of 2001 dollars.

- Data not provided to allow calculation of index: http://officeofbudget.od.nih.gov/UI/GDP_FromGenBudget.htm

The current NIOSH federal staffing level is approximately 1,413 Full-Time Equivalents (FTE). This level has fluctuated over the past decade from a low of 1,364 FTE in 1996 to a peak of 1,521 FTE in 2003 and then a subsequent steady decline to the current level. The increases

leading to the peak in 2003 can be attributed, in part, to NIOSH absorbing the research teams of the former United States Bureau of Mines, the establishment of a new Health Effects Laboratory Division (HELD) in Morgantown, West Virginia, and the creation of the National Personal Protective Technology Laboratory (NPPTL) in Pittsburgh, Pennsylvania.

1.5 Planning and Logic Model

NIOSH has a long history of organized planning to optimize its relevance and impact. During the 1980s, NIOSH conducted a series of national symposia on the leading causes of occupational-related illness and injury. Those meetings resulted in 10 written strategies for prevention that guided NIOSH research programs during the early 1990s.

In April 1996, NIOSH and its partners unveiled NORA, a framework to guide occupational safety and health research into the new millennium—not only for NIOSH but for the entire occupational safety and health community. Approximately 500 organizations and individuals outside NIOSH provided input into the development of NORA. The NORA process resulted in a list of 21 research priorities in occupational safety and health [www2a.cdc.gov/nora/]. Teams of researchers and other stakeholders were organized primarily according to types of health problems or disciplinary approaches for each of these priority areas. Many of the teams published agendas for research. NIOSH researchers were prominent in those efforts.

During the NORA process, NIOSH developed a strategic plan in 1997 and followed it until 2002. [9] A new plan was developed for 2004 to 2009. [10] The strategic goals of this new plan are to:

1) Conduct research to reduce work-related illnesses and injuries.

- Track work-related hazards, exposures, illnesses and injuries for prevention.
- Generate new knowledge through intramural and extramural research programs.
- Develop innovative solutions for difficult-to-solve problems in high-risk industrial sectors.

2) Promote safe and healthy workplaces through interventions, recommendations, and capacity building.

- Enhance the relevance and utility of recommendations and guidance.
- Transfer research findings, technologies, and information into practice.
- Build capacity to address traditional and emerging hazards.

3) Enhance global workplace safety and health through international collaborations.

- Take a leadership role in developing a global network of occupational health centers.
- Investigate alternative approaches to workplace illness and injury reduction and provide technical assistance to put solutions in place.
- Build global professional capacity to address workplace hazards through training, information sharing, and research experience.

To address these new strategic goals and the needs of the next decade, NORA has been modified [<http://www.cdc.gov/niosh/NORA/>] The second decade of NORA is organized to prepare research agendas along the lines of major industrial sectors. These research agendas are being

developed with broad involvement and input from all parties with an interest in occupational safety and health. This renewal for NORA is intended to allow NIOSH to more effectively address the needs of U.S. industries and workers.

NIOSH has developed an operational logic model to assure that its strategic planning activities are logical and appropriate, optimizing NIOSH's relevance and impact (Figure 1.3). The logic model formally depicts the planning process. It moves from left to right across the chart, beginning with production and planning inputs. Those inputs lead to NIOSH research activities. The outputs of NIOSH research activities lead to customer activities. Some NIOSH customers are intermediaries who use or adapt NIOSH outputs before they reach the final customers: employers, employees, industries, educators, and regulators. Their actions help NIOSH to contribute to the improvement of safety and health in the workplace. This process is affected by a variety of external factors including economic and social conditions and the regulatory environment.

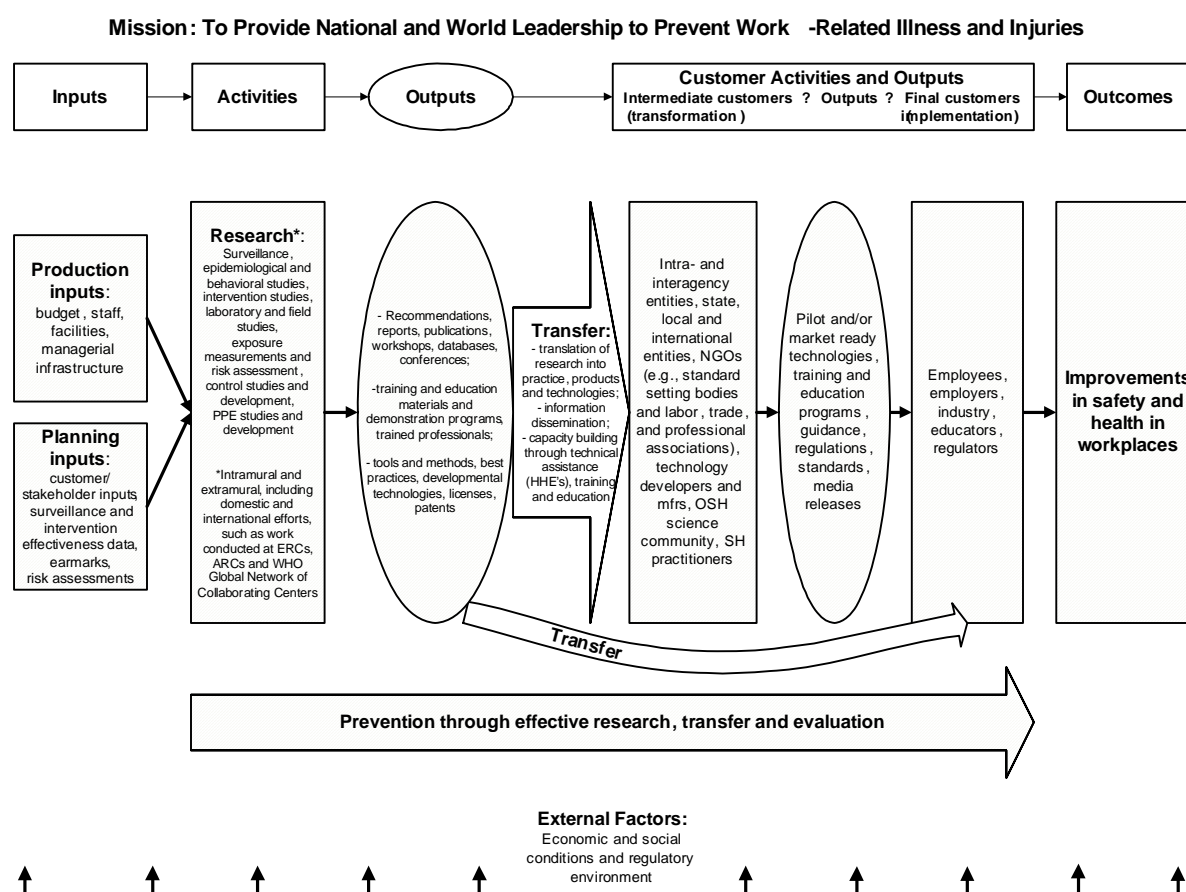


Figure 1.3 - NIOSH Operational Logic Model of Work Related Injuries and Illnesses

A brief discussion of logic model elements follows.

Planning inputs are data that guide NIOSH to action. Many sources provide input such as surveillance programs and risk assessments. One of the major planning activities for NIOSH is

the collection, analysis, and interpretation of health and hazard data. NIOSH uses illness, injury, fatality, exposure, and hazard data for those purposes. NIOSH engages in surveillance to obtain data that can guide its efforts. The NIOSH Worker Chartbook, [4], now in its second edition, is an important source of occupational health surveillance data.

It is often overlooked that inputs do not only start activities; they also stop those activities that have been completed, have become lesser priorities, or have otherwise outlived their usefulness.

NIOSH conducts a range of activities including many types of research, field investigations of workplaces, surveillance, policy and standards development, respirator certification, and health communications.

More than 1,000 active research projects are being conducted at NIOSH. These projects encompass areas and disciplines such as:

- Hazard control development and testing, exposure assessment, epidemiology, behavior, toxicology, biology, and risk assessment.
- Development and testing of personal protective equipment for the workplace.
- Development of environmental sampling and testing methods.
- Performance of laboratory-based and field research: intramural, extramural, domestic, and international.
- Development and assessment of practical workplace interventions, and promoting the adoption of effective interventions in the workplace.

NIOSH also operates two fatality investigation programs, one specifically focused on line-of-duty deaths among firefighters and one addressing fatalities for all other workers. In both programs, investigators assess the circumstances around each fatality to formulate prevention strategies. Plans are then designed for disseminating those strategies.

Another activity supported by NIOSH is training. NIOSH-supported training prepares professionals in occupational safety and health and also transfers NIOSH outputs into the workplace. NIOSH developed university-based Education and Research Centers (originally named Educational Resource Centers) in 1977 to meet the need for trained safety and health professionals. NIOSH currently funds 16 Education and Research Centers at leading universities to provide graduate and continuing education programs in occupational medicine, occupational health nursing, industrial hygiene, safety, and other related disciplines. These centers also serve as regional resources for all those involved with occupational safety and health, including industry, labor, government, academia, and the general public. The centers are funded for 5 years at a time through a competitive peer-review process. NIOSH also supports approximately 40 smaller training project grants focused on providing qualified professionals for the field.

1.6 Outputs and Transfer

The result of research is new knowledge. New knowledge serves society by providing practical guidance on matters of importance to the population. Research programs are obligated to contribute to the advancement of society by integrating this new knowledge. NIOSH carries out the responsibility to disseminate results of its research and activities with a variety of outputs,

including reports, publications, recommendations, workshops, databases, tools and methods, training and education materials, demonstration projects, best practices, developmental technologies, PPT standards, respirator certifications, licenses and patents.

The Office of Health Communications works to maximize the impact of NIOSH outputs through effective transfer to customers, collaborating with each research program to plan and execute communications strategies that reach a variety of customers. Customers include employers and their representatives (such as trade associations), employees and their representatives (labor unions), standards development organizations, professional associations, and the general public.

NIOSH researchers publish in peer-reviewed publications and present their work at conferences. They also publish NIOSH documents and other information products. The NIOSH publications office stocks more than 4,200 NIOSH document titles. It distributed nearly a million printed publications and CD-ROMs in 2003. In addition, NIOSH publications and products are accessible in the NIOSH website

[http://www.cdc.gov/niosh/pubs/all_date_desc_nopubnumbers.html] A survey of four occupational safety and health professional organizations indicated that NIOSH is effectively reaching intended audiences with credible and useful information.

Other special types of outputs include testimony on behalf of proposed regulations, documents recommending criteria for health and safety hazards in the workplace, and other NIOSH-numbered documents. NIOSH-recommended criteria represent the formal link between NIOSH and OSHA or MSHA; and between research and rule-making. For example, NIOSH scientists recently testified to OSHA about a proposed new rule on hexavalent chromium, a carcinogen and skin irritant.

Since its inception, NIOSH has been committed to informing customers about its research. In recent years, use of newer electronic media has enhanced this effort. NIOSH has a website that supports approximately 500,000 user sessions (and about 2.8 million page views) per month. NIOSH also operates a technical information inquiry service that includes an 800 number and an Internet inquiry response service. In FY 2003, NIOSH responded to more than 100,000 inquiries by phone and almost 3,800 by Internet.

In 2004, NIOSH created an Office of Research and Technology Transfer to provide formal administrative support for the concurrently developing NIOSH Research to Practice (r2p) Initiative. The office and r2p policies help ensure that NIOSH researchers consider translating their research findings into best practices, products, and technologies and disseminating those products from the very beginning of their research projects.

1.7 Outcomes

As NIOSH research is transferred, the Institute often moves into more dependent partnerships with others, and has less control of what happens. The resources required to have an effect are less predictable, the outcomes less sure, and the results harder to verify. These partners include employers, labor and industry groups, and regulatory bodies. Partners also include manufacturers who adopt new NIOSH technologies as products for the marketplace, or help develop them

409 further. These *customer activities and outputs* are crucial to NIOSH having impact in the
410 workplace. Influencing and motivating the actions of others are considered *intermediate*
411 *outcomes*.

412
413 An *end outcome* is a NIOSH contribution to reducing morbidity or mortality due to occupational
414 injuries or diseases. Especially for diseases of long latency, such as induction of cancer by
415 carcinogens, objective evidence of reduction in causative exposures may be considered a
416 surrogate outcome, as in the NIOSH PART goal specifying reduction in coal mine dust exposure.

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